



# Using Visible Light Communication in the Smart City Context

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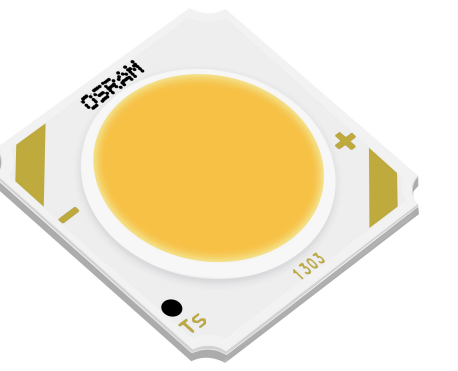
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## Context and goals

- **Evaluate** the performance of **VLC** in different **smart city** applicative **use cases** such as **smart objects**
- Propose a series of **smart city services** based on **VLC**
- Propose **an efficient** communication **protocol** at **the MAC layer** to take into account the **integration of VLC objects**

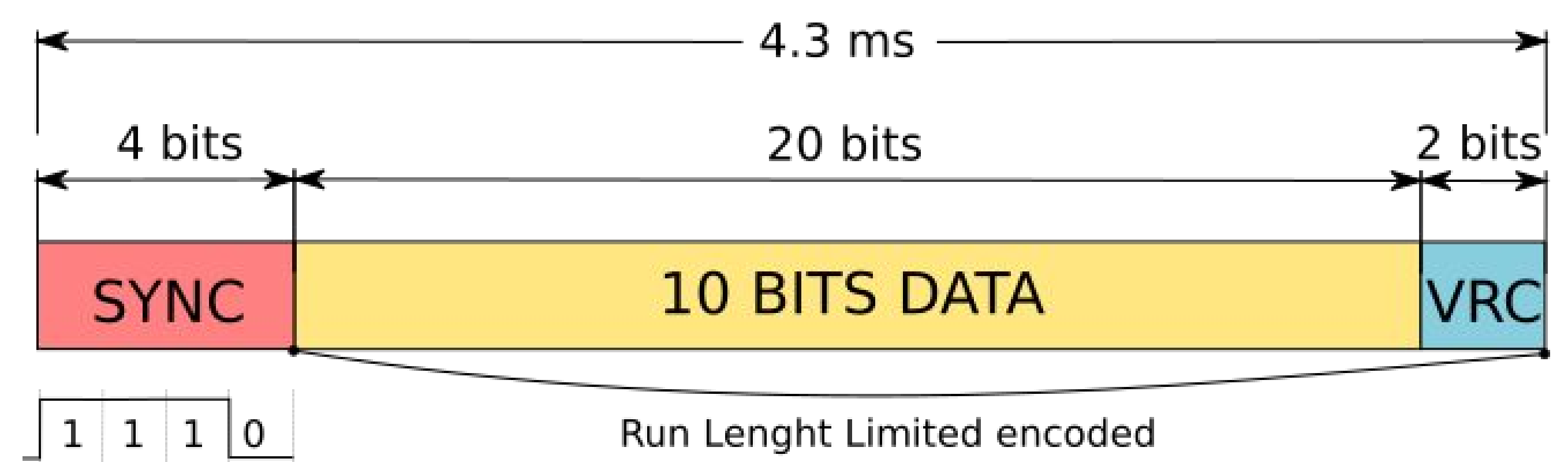


## LEDs as Emitter

- **IM/DD Modulations**
  - On-Off Keying
  - Frequency Shift Keying
- Driven by cheap **MCU**

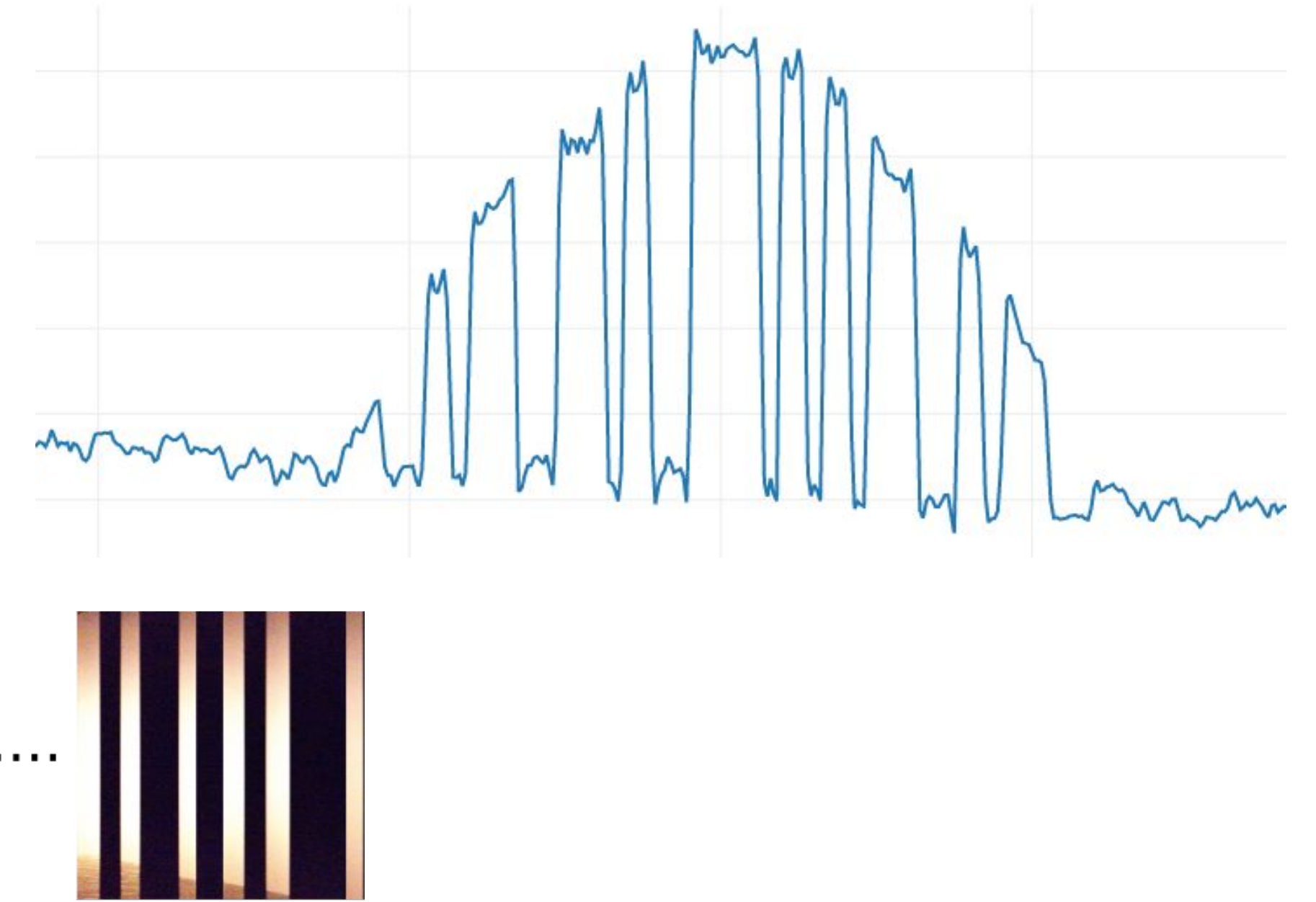
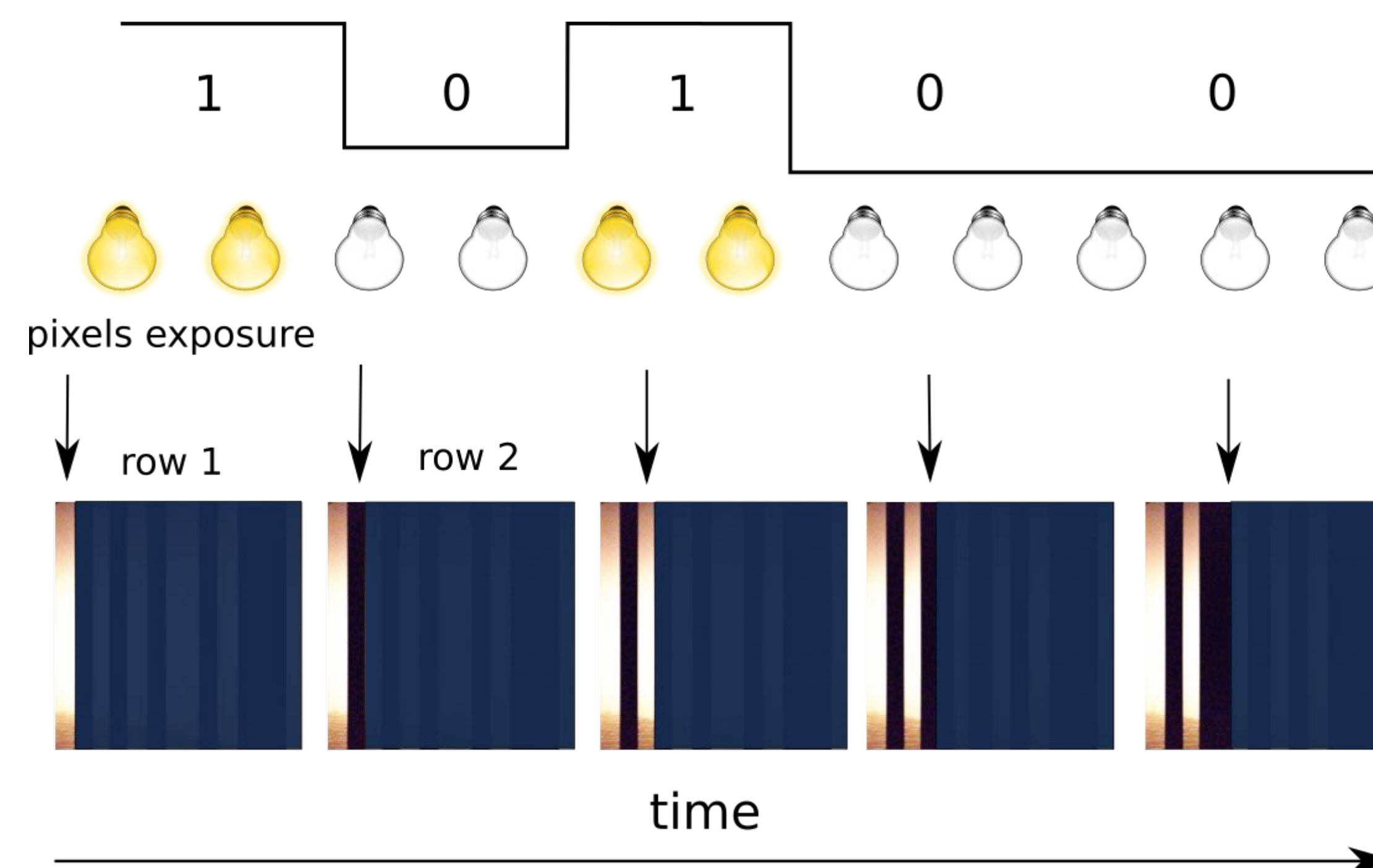
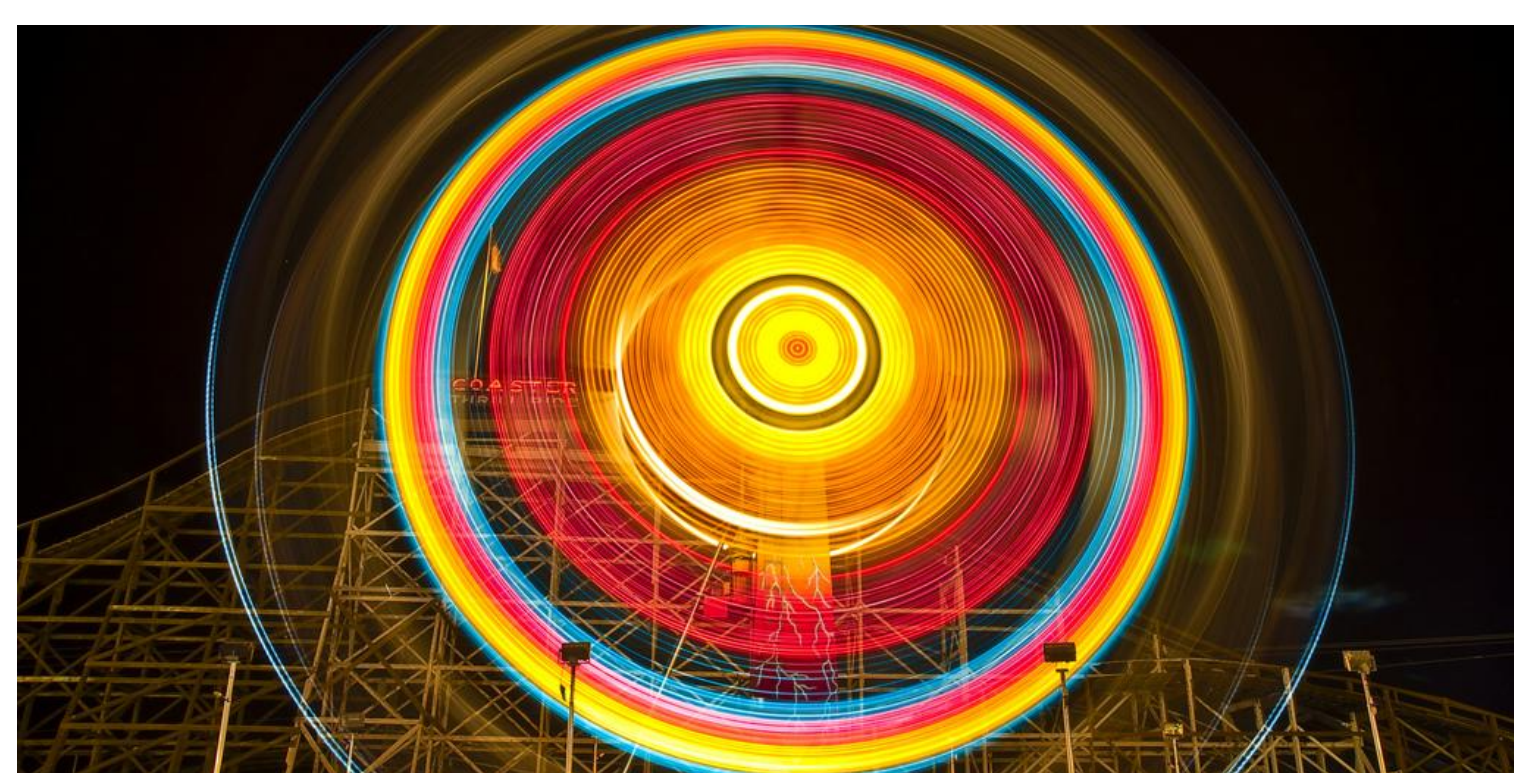
### PHY Layer

- 6KHz OOK
- Manchester
- 500-4000 bit/s



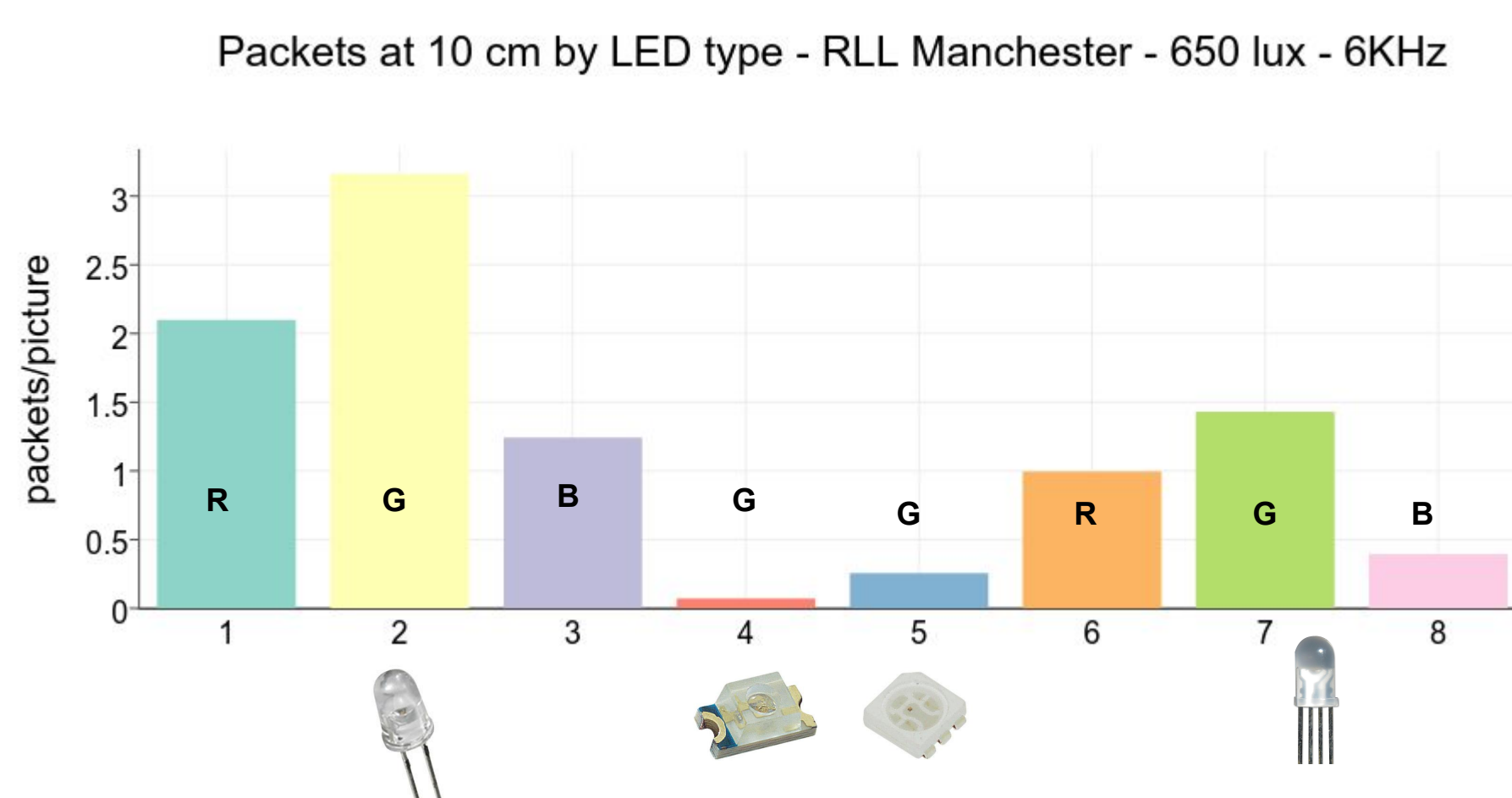
## Smartphone as receiver

- Camera : **CMOS** Sensor
- Rolling Shutter Effect

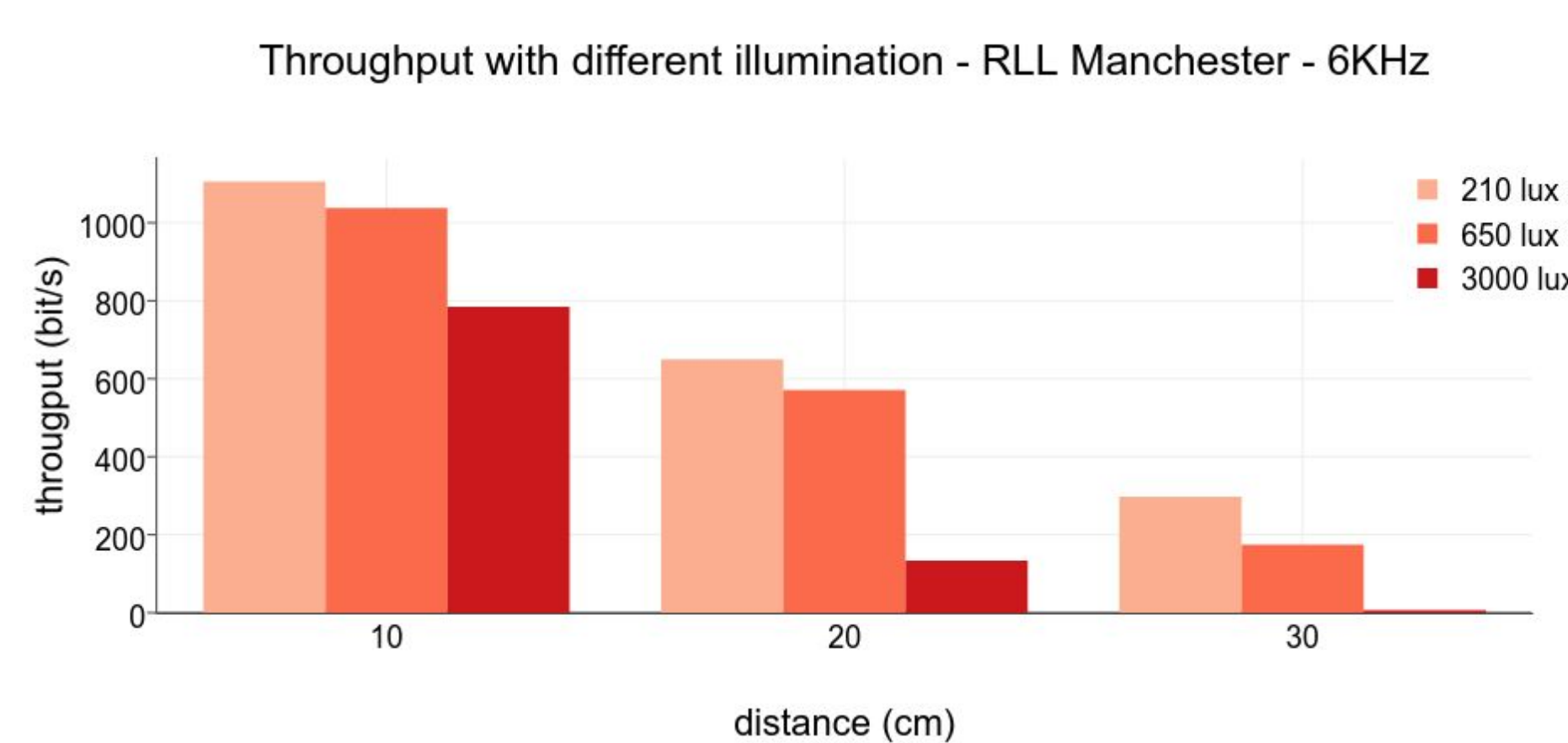


## Evaluation

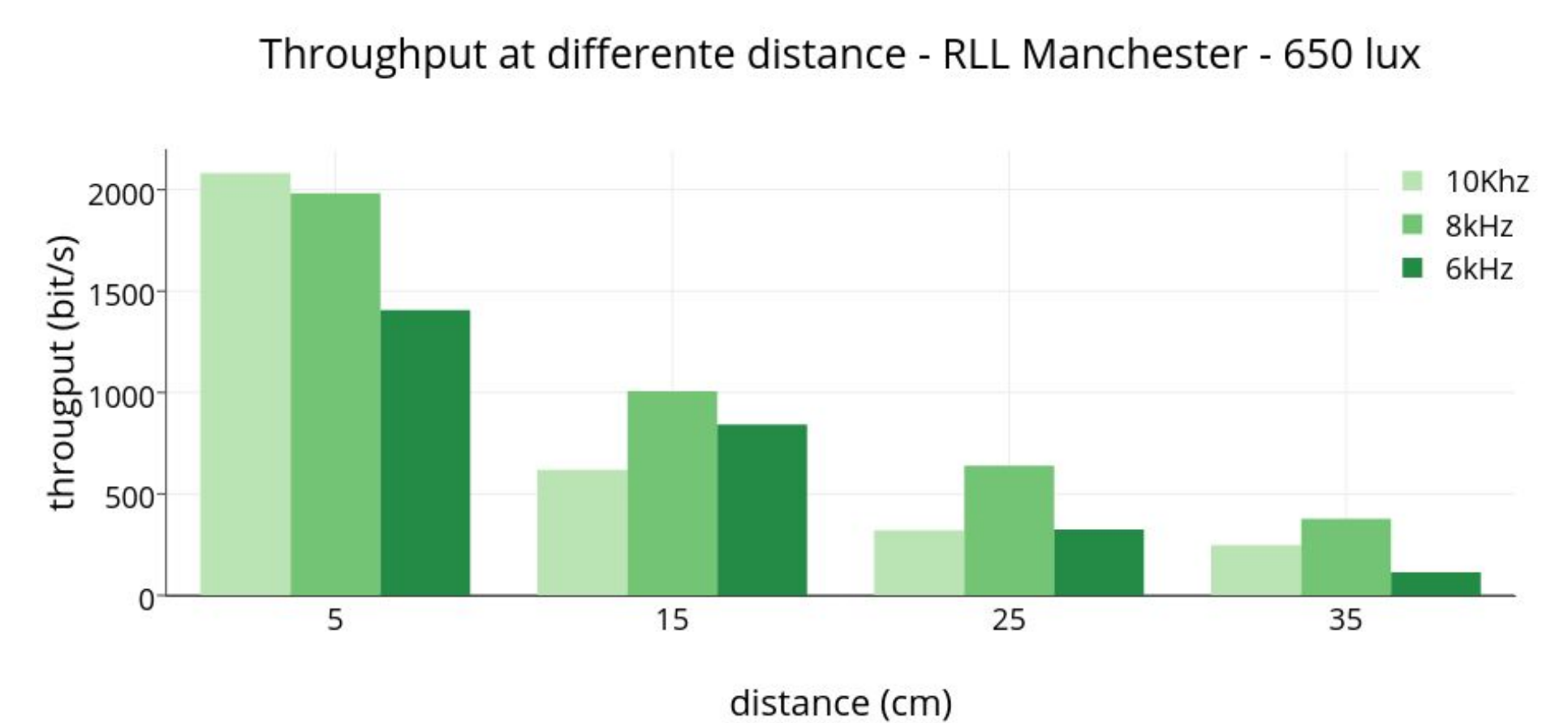
### LED type & color impact



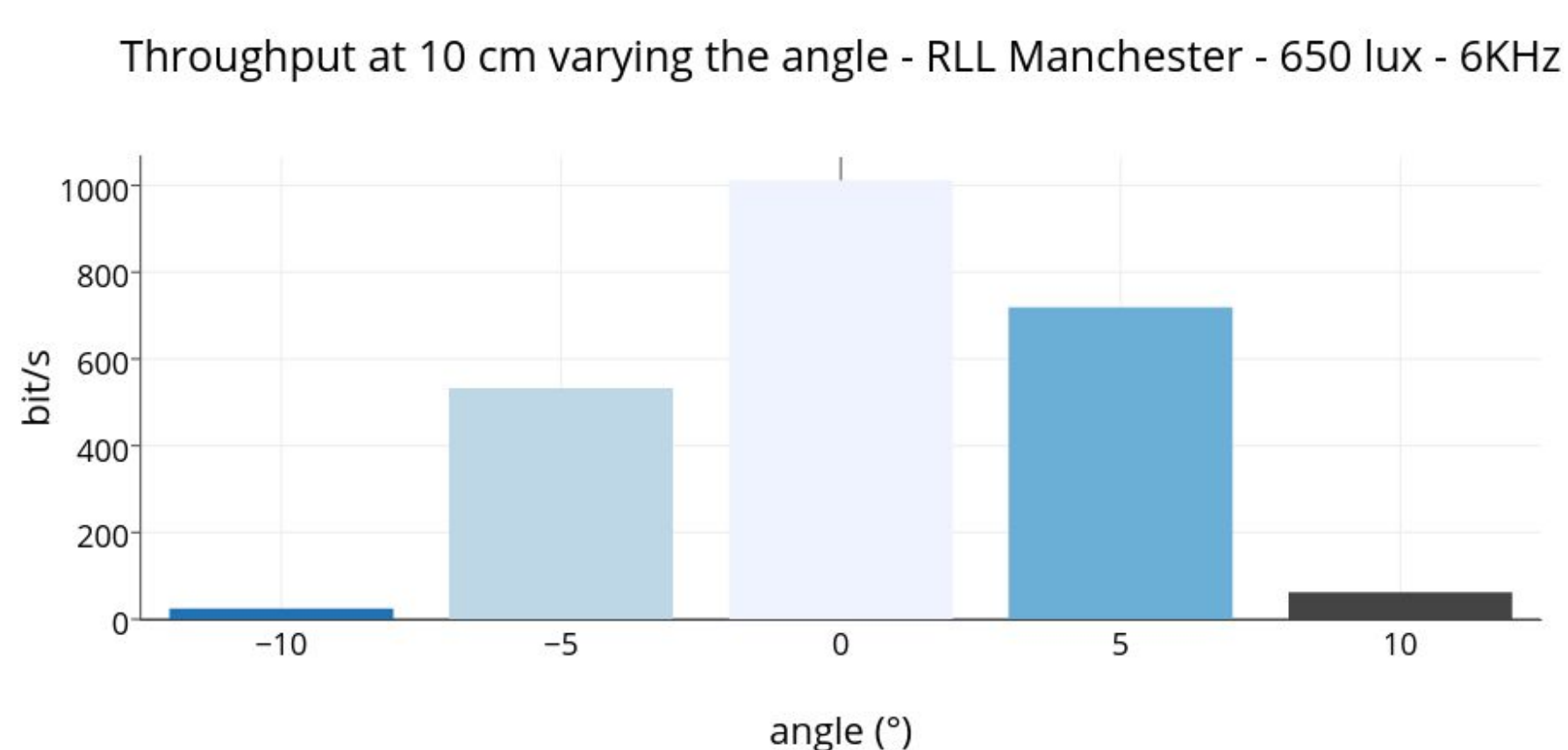
### Illumination impact



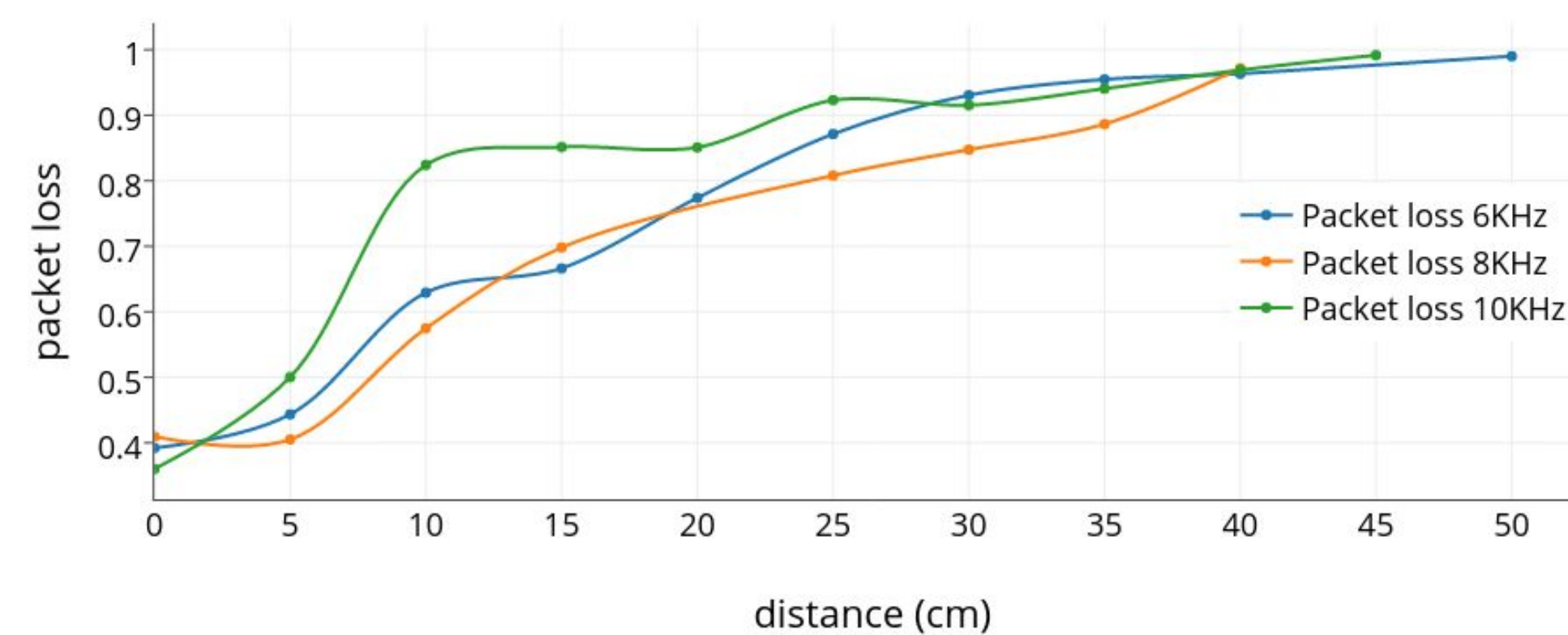
### Achieved throughput



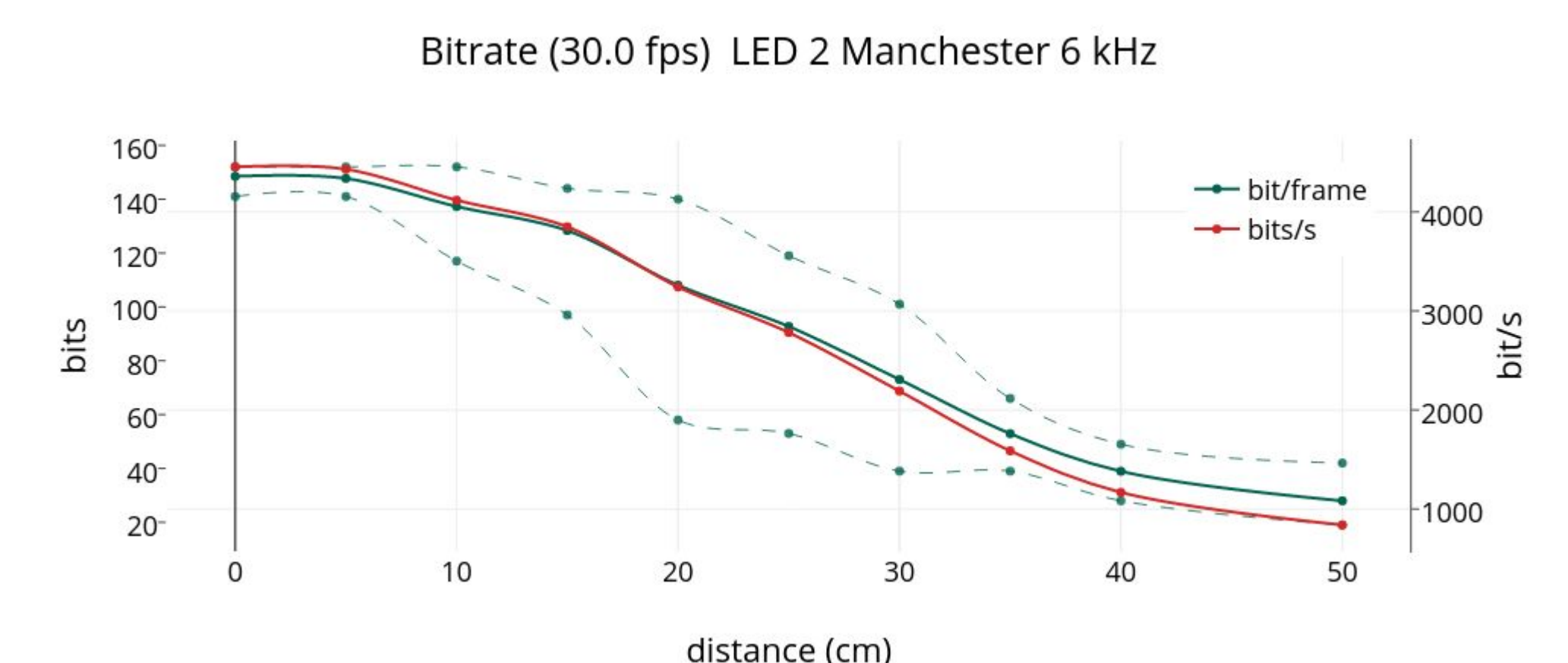
### Angle impact



### Packet Loss



### PHY Bitrate



## Use Cases

- **Low cost** wireless & smart device
- Accurate **Indoor Localization**
- Secured **Near Field Communication**
- **Contextual Information** broadcasting

